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ABSTRACT
        This study investigated the development of story
recall in elementary school children through development of a model
of story comprehension which specified both the rules for
informational transformations and elaborations and the nature of the
organizational structure of stories. Using Rumelhart's (1974) schema
for analyzing stories in terms of a network of information categories
and the logical relationships which exist between these categories, a
story was constructed which contained 23 informational units. The
story was read to 15 first graders and 15 third graders, with recall
required after 20 seconds and again after a delay of one week. The
data were analyzed in two different ways: (1) analyses pertaining to
both the total number of categories accurately recalled by subjects
and to a comparison of the categories recalled in the story; and (2)
analyses pertaining to elaborations on the original story both as
transformations of the original categories and as additions of new
information. Results of these analyses are outlined and it is
concluded that Rumelhart's schema appears to have value in directing
further research in the comprehension of story material. (ED)

*A Developmental Study of Children's

Recall of Story Material

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The present study investigates the development of story recall in elementary school children. Three primary questions were raised: 1) how is story information organized as evidenced by recall; 2) how does the organization of recall change developmentally; and 3) what are the changes that occur within individual subject's recalls over a week's period of time.

The comprehension of narrative material has received relatively little attention since Bartlett's pioneering work (1932). Bartlett examined memory for narratives in adults and showed that narrative recall is highly organized and that subjects do not remember the exact syntactic and semantic structure of the material. The information undergoes blending, omissions, invention and similar constructive transformations. Bartlett felt that in most instances subjects tended to get an impression of the whole, and on the basis of this impression, subjects constructed the detail of the story.

Recently, a number of studies have been completed which measure the retention of information contained in several sentences. Developmental studies in this area (Paris and Mahoney, 1974; Paris, Mahoney, and Buckholt, 1974; Barclay and Reid, 1974) have shown that children, like adults, integrate information presented in several sentences into holistic descriptions. Children cannot differentiate between the originally presented material and recognition items which contain information implied by the original sentences.

These studies are critical in assessing the comprehension of narratives and story material. However, it remains necessary to develop a model of story comprehension which specifies both the rules for informational transformations and elaborations, and the nature of the organizational structure of stories.

Rumelhart (1974) has postulated a "schema" for analyzing story material. He has stated that stories, like sentences have an internal organization. His story grammar includes rules for analyzing stories in terms of a network of information categories and the logical relationships which exist between these categories. His grammar is defined by a set of syntactic rules and a corresponding set of semantic rules. The syntactic rules define the informational categories in a story and the temporal order that should exist among the categories. The semantic rules define the types of logical relationships which can occur between informational categories.

A grammatical category in Rumelhart's grammar is defined by the type of information it contains and not by such linguistic units as a proposition, clause, or sentence. The seven basic grammatical categories of his grammar are:

1). Setting: the time, location, physical or social context of a story. The information in this category is stative in nature. An example of a setting category is: Once upon a time, there was a little girl named Mary.

2). Event: a change of state which occurs in the physical environment. It also can be an action on the part of a secondary character in the story. However, the essential component of an event statement is that it refers to a situation which is not caused by the main character and yet influences the main character.

3). Internal response: this category is very broad and encompasses at least three subordinate categories:

    a). goal or desire: a desire or intention of a character. It assumes that behavior is directional and purposive.

    b). emotion: various types of affective states expressed

by characters, i.e., he was very angry; she felt disappointed.

c). cognition: a character's internal representation of an external event or of internal states. Two examples of cognitions are: "They knew about the trial" or "He thought about what she might be feeling."

4). Method: a decision to pursue an activity; for example. "He decided to go to the party." It refers to a plan constructed by an individual.

5). Activity: purposive action on the part of the main character; it is an action motivated by a goal.

6). Consequence: this concept refers to the end result of an action or event. A consequence statement is in many instances an action also; however, it refers to the end-state of a behavior situation and can be caused by an activity or an event.

The relationships between these categories are described by the syntactic and semantic structure contained in Figure 1. The rules for the two structures are explained below and the reader can refer to Figure 1 for clarification. The rules are as follows:

Rule 1:   Story ——> Setting + Episode

Rule 1':   Allow   (Setting, Episode)

Syntactic Rule 1 reads: A story consists of a setting plus an episode. A setting is the first grammatical category. An episode, like a story, is not a grammatical category but a superordinate structure containing the remainder of the categories. Rumelhart does not make explicit the distinction between a grammatical category and a superordinate structure. However, this distinction is implicit in his grammar. The ALLOW relationship is a weak causal relationship and creates the frame of reference for the story. It is not a cause and effect relationship. The

fact that setting are stative in nature is defined by:

Rule 2:   Setting ——→ State(s)

which says that a setting is equivalent to a state. If two or more set-ting statements occur in the initial part of the story, the semantic re-lationship which exists between the statements is defined by:

Rule 2':   AND   (State, State)

This relationship between setting statements denotes co-occurrence and implies no causal relationship. An example of two setting statements occurring together would be, "Once, there was a little girl named Judy. She was ten years old." The semantic relationship, although implicit, is an AND relationship.

The next two syntactic rules define an episode and an event:

Rule 3:   Episode ——→ Event + Reaction

Rule 4:   Event ————→ Change of State

Action

Story

Event plus consequence

Rule 3 defines an episode as an event plus a reaction to the event. An event is Rumelhart's second grammatical category and is defined by Rule 4. As stated earlier, an event usually refers to a change of state or an action on the part of a minor character. For example, if the state-ment, "Mary went walking with her brother Michael." appeared at the be-ginning of an episode without a goal statement preceding it, the state-ment would be classified as an event. In addition, an event can also be defined as an event plus a consequence. For example, the two statements, "It started to rain outside. Then the plaster from the ciling fell on the new couch." can be classified as an event plus a consequence. These two statements combined together form an event. An event can also be

defined as an entire story so that an entire behavioral sequence becomes
an event. The event category is the most general and ambiguous category
in Rumelhart's grammar.

The next two semantic rules define the types of logical connections
that exist between event statements and other categories:

> Rule 3':   Initiate (Event, Reaction)

> Rule 4':   Cause (Event, consequence)

The semantic Rule 3' defines the relationship between an event and a re-
action and should be read as an event initiates a reaction. By structuring
the grammar in this way, Rumelhart has stated that a reaction cannot occur
unless there has been a prior event; in other words, the event category
begins the sequence of occurrences. Rule 4' refers to the relationship
between an event and a consequence and states that an event can cause a
consequence.

Rule 5 and Rule 5' define the nature of a reaction:

> Rule 5:   Reaction———>Internal Response + Attempt

> Rule 5'   Motivate (Internal response, Attempt)

A reaction consists of an internal response plus an attempt. The semantic
relationship between them is a causal link. It states that an internal
response MOTIVATES an attempt. Again an attempt is a superordinate cate-
gory consisting of a method plus an action; this is defined by Rule 6
and Rule 6':

> Rule 6:   Attempt———>Method + Action

> Rule 6':   Motivate (Method, Action)

These two rules define an attempt and specify the relationship which exists
in the attempt category. Rule 6 states that an attempt is defined by a
method or plan plus an action, and Rule 6' states that a method motivates
an action to occur.

The seventh set of rules are:

Rule 7:   Action ——→Activity + Consequence

Rule 7':   Cause (Activity, Consequence)

Thus an action consists of an activity plus a consequence, and Rule 7' states an activity causes a consequence.

When the syntactic units are combined, a nested hierarchical structure is produced:

```
                     Story
                    /    \
            Setting      Episode
                        /      \
                   Event        Reaction
                               /        \
                      Internal           Attempt
                      Response          /      \
                                   Method       Action
                                               /      \
                                        Activity       Consequence
```
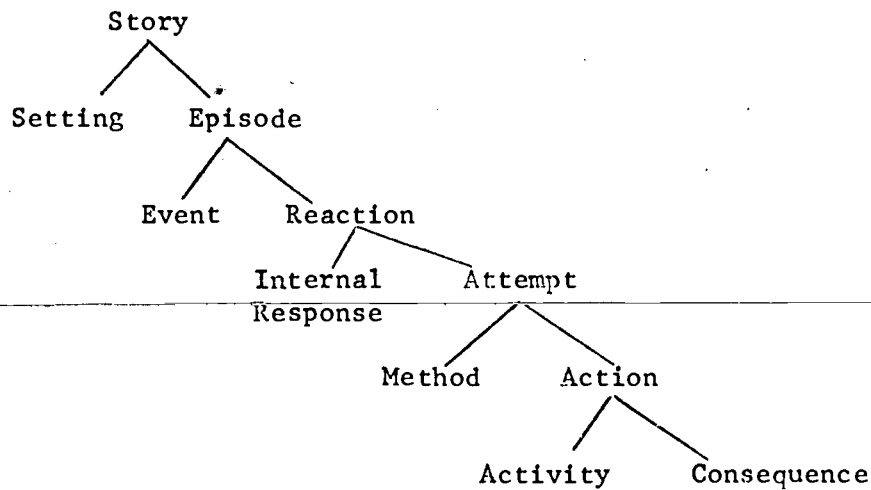
The semantic relationships which exist among the categories can be seen below:

```
            Setting
              |
            ALLOWS
              |
            Event
              |
            INITIATE
              |
            Internal Response
              |
            MOTIVATES
              |
            Method
              |
            MOTIVATES
              |
            Activity
              |
            CAUSE
              |
            Consequence
```
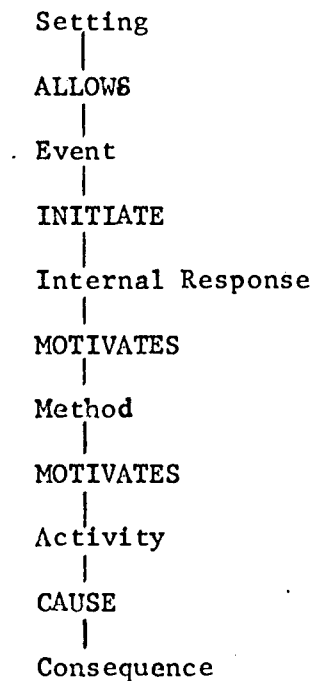
It should be noted that the semantic diagram does not include the superordinate categories but only the six grammatical categories. The semantic chart presents the logical flow of the story more concisely.

Rumelhart's grammar was utilized to analyze the data from the story recails. His approach has several strengths. It can be used to determine whether certain categories are more salient than others. In addition, the types of transformations, integrations and inferences included in recall should be predictable from his grammatical rules. For example, his syntax specifies that a reaction consists of an internal response, a method, an activity, and a consequence. If one of the categories is deleted in the target story, the subject should infer what the particular missing category is and include it in his recall.

METHOD

Subjects: Fifteen first grade children and fifteen third grade children participated in the study. All children came from an upper middle class school in Saint Louis County.

Stimulus Materials: A story which involved a girl who had to baby-sit for her younger brother was constructed. It contained 23 informational units, and the parsing according to Rumelhart's grammar can be seen in Figure 2.

Procedure: The story was read to each child participating in the study. After each subject heard the story, a twenty second delay occurred. The subject was then asked to recall the entire story. One week later, all children were again asked to recall the entire story.

RESULTS

The data was analyzed in two different ways. The first set of analyses pertains to both the total number of categories accurately recalled

by subjects and to a comparison of the categories recalled in the story.
In the second set of analyses, the elaborations which include both trans-
formations of the original categories and additions of new information are
discussed.

1. Accurate Recall.

A two way analysis of variance (2 grades as between subject variables
and 2 times as within subject variables) was carried out on the total
number of informational units recalled. The main effects of grade
($F (1,56) = 43.49$; p .001) and time ($F (1,56) - 4.93$; p .03) were
significant. Third grade subjects recalled significantly more information
than first graders and both groups recalled more on immediate recall than
in delayed recall.

The informational units were then grouped into the six grammatical
categories. Six separate two way analyses of variance (with grade and
time as the main variables) were then completed on the total number of
units recalled for each of the six grammatical categories. The results
can be seen in Table 1. It was found that third grade children recalled
significantly more information in each category with two exceptions. There
were no significant differences between grades for the methods or setting
categories. The main effect of time was significant for two categories:
the internal response category and the setting category. The frequency
of recalling both of these categories dropped over time (see Table 1)

To assess the saliency of each informational unit within story recall
a rank ordering procedure was utilized. The ordering consisted of the fre-
quency with which each unit was recalled. Separate orderings were con-
structed for each grade level and each time condition. A Spearman rank
order correlation was performed to assess the relationship between grades
and time conditions. The correlation between grades was .91. This is

highly significant and shows that although there were some differences in the categories remembered by different aged children, the saliency of particular items in story recall is extremely consistent across the two age groups. The corresponding rank order correlation between time 1 and time 2 is 0.90. Thus the pattern of recall remains highly consistent over time.

The rank orderings were then divided into thirds. It can be seen from Figure 2 that both consequence and event statements were fairly well recalled. Four out of five consequence statements appear in the upper third of the rank order. The remaining consequence statement is in the middle third. One event statement occurred in the upper third of the ordering, and two were in the middle third.

Of the remaining categories, internal responses are neither the best remembered nor the least remembered categories. The three affective statements were found in the middle third of the ordering; the one cognition was found in the lower third. The goal statements were generally not well remembered; one goal statement is found in the middle third of the rankings and the remaining two are found in the lower third. It should be noted, however, that the consequences implied by these goals were well recalled. The frequency with which activity statemnnts were recalled varied widely. Three activity statements were in the top third of recalled information and three were in the bottom third. The three activities that were remembered best were statements which contained new information not implied in any other category.

The method and setting statements were the least frequently recalled categories in the story. However, it should be noted that there was only one setting statement and one method statement in the story and no conclusions can be made from single observations. Furthermore, in our story,

there was no setting statement at the beginning of the episode as Rumelhart postulates in his grammar. In addition, the one setting statement, "While Mary was gone," was often transformed into an activity statement such as "When Mary came back," or "Mary came back." Thus, the information in the category was recalled but changed to a different category. In order to show that setting statements are recalled less frequently than other categories, the number of setting statements and their relative position in the story must be better controlled. The methods category also occurred only once in the Mary story, and was not recalled frequently.

The fourth question raised was how well the temporal sequence found in the recall data matched the sequence of the original story. An index was constructed by calculating a Spearman rank order correlation for each individual protocol and a mean was calculated for each of the 4 conditions. These are presented in Table 2. No significance tests were completed on the group data because the number of categories recalled varied across subjects. However, it can be seen that third grade subjects sequence the story material almost perfectly in both time conditions. All individual correlations in both time conditions were above 0.93. One type of sequencing error accounted for 75% of the total errors made by third grade subjects. Consequence 22, the last statement in the story was transposed and recalled immediately after Activity 14 (see Figure 1 for story parsing). First grade children recalled the story in good order also. However, more errors were made by first grade subjects than by third grade subjects. On immediate recall, 12 out of 15 subject recalls received a correlation of 0.83 or above. Eighty-percent of the errors in the immediate recall condition were made by three subjects. The errors

could not be categorized into specific types of errors. However, first grade recalls were more ordered on delayed recall than on immediate recall. The same three subjects that recalled the material poorly in immediate recall did poorly on delayed recall. Again, these three subjects made eighty-percent of the errors found in temporal sequencing.

2. New Information in Recall.

Two types of additions were consistently found in the recall data: addition of new information and transformations of story information from one type of category to another category. All new information was scored according to semantic content and to the order in which it occurred in the story. An example of added new information is the following: "Mary's mom had to go shopping" (new event statement). An example of a transformation from one category to another was: "Mary sat down and played jacks." In this instance, credit was given for the activity "sat down" but "played jacks" was considered a transformation from a goal statement to a consequence statement. The mean number of additions for the total recall and individual category scores is stated in Table 3.

An analysis of variance with grade and time as the main effects was performed both on the total number of additions and separately for each type of category added. The results showed that both grade and time were significant variables when the total number of additions was analyzed. Third grade children added significantly more new information to their recall than first grade children (F $(1,56) = 12.58$; $p < .001$) and both groups added more new information on delayed recall than on immediate recall (F $(1,56) = 19.80$; $p < .001$). When the added information was broken down by category type, it was found that the main effect of grade was significant for two categories; third grade subjects added a significantly

greater number of consequence statements (F (1,56) = 4.70; p < .03) and setting statements (F (1,56) = 7.71; p < .01) than first grade subjects. The main effect of time was also significant for three categories: internal responses (F (1,56) =11.22; p < .01), events (F (1,56) = 5.19; p < .03) and activities (F (1,56) = 8.09; p < .001) occurred significantly more on delayed recall than on immediate recall. The significant effect of time condition for the internal response category must be interpreted in view of the significant grade x time interaction. Grade three subjects recalled proportionately more internal responses on delayed recall than on immediate recall than did first grade children (F (1,56) = 4.73; p < .03).

The addition of information in the recall protocols was not random. All event and setting additions occurred at the beginning of subject recalls. Almost all setting statements referred to the fact that "There once was a girl named Mary and a boy named Michael" or "there once was a girl named Mary who had a little brother named Michael." Event statements were almost exclusively additions of information to the story. Almost all additions referred to the reason for Mary staying home and babysitting with Michael such as "Mary's family went out shopping so Mary had to stay home and watch Michael."

The internal response category appeared in different positions in recall depending upon the specific type of subordinate category. Goal statements in general occurred immediately after the initial event statements. An example of an added goal statement would be: "Mary wanted to go out and play with her friends," or "Mary wanted to amuse Michael." A few of the added goal statements were transformations of the method statement, "She decided to get Michael cookies." Children instead recalled, "She wanted to get him cookies," or "She wanted to cheer him up."

Affective or emotion statements consisted entirely of added information.
Many of the additions occurred for the affective category "Mary was feeling
annoyed." Many children added or substituted statements such as Mary felt
sad, jealous, really sorry for herself, etc. Several of the added affective
categories also referred to Mary's feelings after Michael built the tower.

Cognitions were rarely added to the story by either group of children.
When this did occur an activity or consequence statement occurred immedi-
ately afterward.

Activity statements were added in all parts of the story. Over fifty-
percent of the added activity statements were transformations of the cogni-
tion statement "Mary saw that Michael was getting sad." Children transposed
this statement into "Mary looked at Michael. His face looked sad."

The added consequence statements were both additions and transpositions
of the original material and occurred in two specific places in the story.
All transformations concerned the goal statement "Mary sat down to play
jacks next to him." Subjects who transposed this information stated Mary
sat down and played jacks next to Michael. All consequences that were con-
sidered additions were added to the end of the story. Children added
statements such as "Mary gave him a cookie" and They both ate the cookies."

DISCUSSION

The main points are as follows:

1. Third grade children recall more of the story categories accurately
than first grade children, and all children recall more accurate information
in the immediate time condition than in the delayed recall condition.

2. Not all items were equally salient. Some items were recalled
consistently better than other items and the pattern of recall, i.e., the
relative salience of each informational item was highly consistent both

between grades and over time. These findings suggest that although there are differences in recall over grade levels and time conditions, there are great similarities also.

3. Not all categories were equally salient in recall. Events and consequences were recalled most often. The recall of activity statements varied widely. Internal responses were neither the best or least remembered items. Method and setting statements were the least remembered.

4. The temporal ordering of the originally presented story material was reproduced by almost all children in both grade levels. This suggests that when items are sequenced in accordance with the order Rumelhart postulates for stories, the sequence is preserved.

5. All recalls included elaborations of the originally presented story material. Both additions of new information and transformations of the original categories were classified as elaborations. Third graders added significantly more elaborations than first grade children and both groups added more elaborations on delayed recall than on immediate recall. The elaborations were not randomly introduced into the story recalls. Most of the additions occurred when there were missing categories in a behavioral sequence as postulated by Rumelhart. The two most frequently added categories in both groups of children were internal responses and consequence statements.

Thus the model that Rumelhart postulates for the existence of an internal representation for stories appears to have value in directing further research efforts in the comprehension of story material. However, the model is in a very preliminary stage and needs much more research to define the validity of the category distinctions and the postulated temporal ordering.

FIGURE 1

Syntactic Rules		Semantic Rules
1. Story	Setting + Episode	ALLOW (Setting, Episode)
2. Setting	State(s)	AND (State, State)
3. Episode	Event + Reaction	INITIATE (Event, Reaction)
4. Event	Change of State	
	Action	
	Story	
	Event plus consequence	CAUSE (Event, Consequence)
5. Reaction	Internal Response + Attempt	MOTIVATE (Internal Response, Attempt)
6. Attempt	Method + Action	MOTIVATE (Method, Action)
7. Action	Activity + Consequence	CAUSE (Activity, Consequence)

FIGURE 2

Category	Informational Units	Rank of Units Over All Conditions
1. Event	Mary had to stay home	11
2. Event	and watch herlittle brother Michael.	2
3. Event	All her friends were outside playing.	9
4. Affect	Mary was feeling annoyed.	16
5. Activity	She went	18
6. Goal	to get toys for Michael to play with.	21
7. Consequence	She brought blocks, jacks her Raggedy Ann doll and a toy truck.	4.5
8. Consequence	She shoved the blocks in front of Michael	14
9. Activity	and sat down	20
10. Goal	to play jacks next to him.	23
11. Activity	Michael attempted to build a tower,	7
12. Consequence	but he couldn't get it right.	6
13. Cognition	Mary saw that	15
14. Affect	Michael was getting sad.	10
15. Method	Mary decided	22
16. Goal	to get a cookie for Michael and one for herself.	12
17. Activity	She went to the kitchen holding her Raggedy Ann Doll.	3
18. Setting	While she was gone,	17
19. Consequence	Michael built a tower.	1
20. Affect	Michael felt proud.	13
21. Activity	Mary came back,	4.5
22. Activity	and saw Michael's accomplishment.	19
23. Consequence	She had a cookie for Michael and one for herself.	8

TABLE 1

Mean Number of Categories Accurately Recalled

Category	Frequency of Occurrence in story	Grade 1 $\bar{X}$	Grade 3 $\bar{X}$	Time 1 $\bar{X}$	Time 2 $\bar{X}$
Setting	1	0.23	0.37	0.43	0.17
Events	3	1.63	2.40***	2.17	1.87
Internal Responses					
Goals	3	0.70	0.93	0.83	0.80
Other	4	1.20	2.33***	2.13	1.40**
Activities	6	1.97	3.40***	2.77	2.60
Consequences	5	2.73	4.17***	3.57	3.33
Methods	1	0.10	0.10	0.06	0.13
Total		8.56	13.70***	11.90	10.33*

***   p   .001

**   p   .01

*   p   .05

TABLE 2

Mean Correlations for Temporal Ordering of Story Material

	Time 1	Time 2
Grade 1	.73	.84
Grade 3	.99	.98

TABLE 3

Mean Number of inferences included in story recall

	Grade 1	Grade 3	Time 1	Time 2
Total number of inferences	2.20	4.03***	1.97	4.27***
Events	0.30	0.53	0.23	0.60*
Internal Responses				
Affects	0.53	0.87	0.40	1.00**
Goals	0.10	0.03	0.03	0.10
Activities	0.33	0.70	0.23	0.80**
Consequences	0.77	1.40*	0.87	1.30
Settings	0.17	0.50**	0.20	0.47*

*** p .001

** . p .01

*   p .05